The Use of Mineral Trioxide Aggregate (MTA) in Root end Surgery: A Case Report

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Non-surgical endodontic treatment gives good and predictable results in most cases, and even in those that present with persistent apical periodontitis. Non-surgical retreatment and re-treatment is usually the preferred option. However, there may be cases when a surgical approach is appropriate:

- When canals cannot be negotiated – due to anatomical considerations or fractured instruments/iatrogenic errors such as perforations
- Failure of previous non-surgical treatment, presenting with persistent symptoms or a periapical radiolucency
- Failure of previous surgery
- Inability to access the root apex non-surgically – in cases with long post and cores, the attempted removal of which could result in root fracture

A predictable treatment

Surgical endodontics has evolved to become a treatment option with predictable outcomes by incorporating the use of modern equipment and techniques, such as the operating microscope, micro-surgical instruments, ultrasonic root end preparation, sutures and flap design and new retrograde root-end filling materials.

An ideal root-end filling material should seal the prepared root surface to prevent bacteria and their products from seeping or entering the canal. Many materials have been used for this purpose with varying degrees of success: amalgam, glass ionomer, zinc oxide – eugenol cements (IRM/Super EBA), glass ionomers, composite resins and mineral trioxide aggregate (MTA).

MTA has caused great excitement since it was introduced in 1995 as a root-end filling material. It consists of tricalcium silicate, tricalcium aluminate tricalcium oxide and bismuth oxide and exists as a white powder mixture. It is extremely nervous and requested the presence of a surgical anesthetist. The UL1 was restored with a well-fitting metal-ceramic crown. The UL2 was restored with a palatal amalgam restoration.

The material is mixed with sterile water to provide a grainy, sandy mixture. Recent reports also indicate a favourable clinical response when mixed with chlorhexidine though there may be differences in sealing ability. The mixture is loaded into special canals (see Figure 2) and introduced to the site and packed with micro-pluggers. There is a learning curve in getting a usable consistency, but as it is hydrophilic paper points can remove some moisture before further increments to allow better packing. Its hydrophilic nature means that moisture or blood does not affect the setting time.

It has a long setting time – three hours, which allows for low contraction and good marginal adaptation. In some techniques, such as perforation repair/apexification, the placement of a moist cotton pellet directly in contact with the MTA is necessary to allow proper setting. More recently a white powder version has also been marketed with a reported reduced setting time and better aesthetics but possibly not as good marginal adaptation.

A Case Report

A 56-year-old male was referred for treatment of UL1 and UL2 due to persistent infection and a previous failed attempt at periapical surgery of UL1. There was a history of trauma when aged 10 with root- canal treatment being carried out on both teeth by his general dentist. The UL1 was restored with a post-retained crown in his late teens. Subsequent to infection an attempt at apical surgery of the UL1 was also carried out.

The initial presentation was of a painless discharging sinus above UL2 of approximately ten years duration. There was evidence of scarring in the buccal sulcus above the UL1, UL2 with a sinus tract present over the UL2. The UL1 was restored with a well-filling metal-ceramic crown. The UL2 was discoloured and had a palatal amalgam restoration. There was no tenderness on palpation or percussion associated with either tooth or the surrounding tissues (see Figure 4).

Adjacent teeth responded positively to pulp testing and radiographs tracking the sinus revealed a large (approximately 1.5cm maximum diameter) periapical radiolucency around the roots of UL1 and UL2. The UL2 was restored with a large cast post extending to half root length and approximately 7mm of root filling beyond. The irregular apex of UL1 was indicative of the previous attempt at surgery (see Figure 4).

A diagnosis of chronic suppurative periodontitis with prior root treatment was made at UL2, and chronic periradicular periodontitis with inadequate root treatment at UL1.

The patient was keen to save both teeth and it was decided to attempt non-surgical retreatment of UL2 and surgery of UL1, and also UL2 if the sinus failed to heal.

The existing gutta percha root filling was removed and endodontic re-treatment of the UL2 was carried out with copious irrigation using sodium hypochlorite. An inter-appointment dressing of calcium hydroxide was placed and at a subsequent appointment the excavator was obturated to the apex using gutta percha and sealer. Glass ionomer cement was used to restore the access cavity (see Figure 5).

The patient was seen six weeks after the root treatment when he complained of a more persistent discharge from the sinus than on previous occasions. At this stage, a surgical option was discussed and it was decided to perform root-end resection and root-end filling of the UL1 and UL2.

Surgical treatment of UL1 and UL2

Due to his previous experience of surgery, he was extremely nervous and requested oral sedation. Consent was obtained and local anaesthesia was administered. A full thickness rectangular mucoperiosteal flap was raised to expose the cortical bone and a fenestration approximately 5mm in diameter between the roots of UR1 and UL2. This was filled with granulation tissue. The bone cavity was extended using a surgical air-rotor and the soft tissue lesion curetted with excavators and preserved for pathological diagnosis (see Figure 6).

The root-ends of both teeth were resected approximately 5mm with as minimal a bevel as possible and the gutta percha fillings and inspected for fracture lines using methylene blue stain. Gutta percha removal and retrograde cavity preparation was carried out using a piezoelectric ultrasonic unit with surgical retrotips. The prepared canals were dried with sterile paper points and the MTA mixed to manufacturer’s instructions and loaded into the carrier. Increments of the mixture were plugged into the prepared cavities until flush, smoothened over with a moist cotton pellet and the flap replaced and sutured in place. A post-operative radiograph (see Figure 7) was taken and 400mg Ibuprofen prescribed to be taken at six-hourly intervals.
Simple smile restoration

Dr Andrew Croston outlines a successful treatment plan to create a better smile using the Clearstep system

A 55-year-old lady attended our practice seeking treatment to improve her deteriorating smile. A thorough examination revealed a well cared for dentition with minor posterior restorations and an excellent level of oral hygiene. Her upper incisors showed moderate incisal wear caused by an edge-to-edge incisal relationship. Both maxillary and mandibular incisors were proclined and the latter were crowded into a more labial position. The resultant wear was producing a noticeable negative smile line on 12, 11, 21, 22. The patient was keen to have veneers placed as she had seen this on a makeover TV programme.

Discussion of the case

After photographs and study models were taken, the case was discussed at length with the patient. The fundamental problem with restoring the lost upper incisal tissue was the position of the lower incisors. As all the incisors were un-restored, any heavy preparation to provide crowns was dismissed. Also, if veneers were to be simply placed on 12, 11, 22, this would result in further proclination which would be aesthetically unacceptable and also unstable as they would be under constant stress from the lower incisors.

It was recommended that orthodontic repositioning of 42, 41, 51, 52 first be accomplished into a more favourable position to provide enough space to restore the upper incisors. Simple lingual tilting of the lower incisors would provide this.

Pros and cons

All orthodontic procedures were discussed with the pros and cons of each being fully described. It was decided to proceed with Clearstep as the patient specifically preferred the fact these would be ‘invisible’ and could be easily removed for eating and cleaning. Silicone impressions, photographs, radiographs and a detailed description of what we required was sent to the Clearstep diagnostic faculty. Clearstep then sent us a full diagnostic report detailing the number of ‘boxes’ required, the estimated timescale and the cost. The case was presented to the patient, consent received and the go-ahead given to Clearstep to proceed with treatment. We were then sent the first box of aligners along with a detailed description of the interproximal reduction (stripping) required to provide the space required. This was achieved by accurately removing between 0.5mm and 1mm off the distal root apices (see Figure 8).

It was decided to review the patient again in a further six months.

A positive outcome

There were no clinical or radiographic signs of healing after root canal re-treatment and with the history of the lesion, surgical treatment was appropriate. The healing response in the seven months post surgery has been excellent. MTA has been shown to be biologically friendly in endodontic surgery and is to date the nearest thing to an ‘ideal’ material; it is non-toxic, non-resorbable with minimal or no leakage around the margins.

It does require careful handling and the need for moisture may mean a subsequent visit to ensure it has set to a concrete-like consistency in situations such as pulp capping, apexification and perforation repair. To date the biological response to MTA has been excellent but as with all relatively new materials further trials and time will tell if it is to be the gold standard in surgical endodontics.